Teaching Paleontology in the National Parks and Monuments

A Curriculum Guide for Teachers of the Fourth, Fifth and Sixth Grade Levels

Produced by the National Park Service, Florissant
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Slide Show Script

1. Title Slide: This slide show is made possible through the ongoing efforts of the National Park Service. The NPS is responsible for preserving some of the very special places in our country. Some of those places are beautiful spots in nature and important wildlife habitat. Others are places of historic value, or even prehistoric value, but eight parks were created just to protect fossils. This slide show will look at those eight parks and the different kinds of fossils they protect.

2. (Ancient Landscape) What are fossils? They are the remains of ancient life. They form under very special conditions and only a small fraction of the life that has existed on our planet has been preserved as fossils.

3. (Forest floor, rotting logs with fungus) What are the special conditions necessary for fossils to form? Usually, if something dies, it either rots away from bacteria and fungus, or is eaten by animals. (Scavengers are animals that live off of dead flesh.) So, a major factor in forming a fossil is rapid burial. This protects the organism from being eaten or exposed to bacteria.

4. Roadcut (Morrison Formation): Most fossils are found in sedimentary rocks. These rocks form when layers of silt, precipitates from water, or volcanic ash build up on the bottom of a lake, pond, marsh or sea. As the layers build up, they compress and harden into sedimentary rocks. There are four different types of fossils that all form in their own special way: petrified fossils, carbon fossils, cast fossils and trace fossils.

5. Stump (Florissant Fossil Beds): Permineralization, or petrification, is one way that organisms are preserved as fossils. Highly porous materials like bones or wood can become petrified if they are buried quickly and thoroughly, before they start to decompose. Permineralized remains are the most common types of fossil found in the fossil NPS parks. Florissant Fossil Beds Nat. Monument has the most massive petrified fossils, the huge trunks of redwood trees. (Although there –are longer ones at Petrified Forest National Park, in Arizona).

6. Redwoods: Redwoods grew in the Florissant Valley of Colorado about 35 million years ago when the climate was much wetter and milder than it is today.

7. Eruption of Mt. St. Helens: A huge volcano stood nearby. When it began erupting, tons of ash was ejected into the air. Much of the ash fell on the sides of the volcano and mixed with melting snow and stream water, producing huge mudflows, or lahars.

8. Mudflows: Lahars such as these at Mount St. Helens are similar to those that flowed down into the ancient Florissant valley and covered the bases of the redwoods. The flows hardened into a rock called tuft.

9. Diagram: Water penetrated through the tuft, dissolving some of the minerals (mostly silica from the volcanic ash). The silica rich water penetrated into the tree trunks. As the silica solution filled in the cells, the cell walls were replaced and gradually the wood was turned to stone, or petrified.

10. Trio: This is what remains today. These stumps stand nearly 11 feet high.

11. Long Logs: Petrified Forest is a National Park where the largest concentration of petrified wood is found. Unlike Florissant where the stumps are found right where the trees were growing, these trees grew 225 million years ago in a vast forest on nearby mountains. They were washed away in a flood and buried in the bottom of a river. The silt that surrounded them gradually hardened into a rock. Then they slowly underwent a petrification process similar to the trees at Florissant. However, this wood is much more colorful than the wood at Florissant because in addition to silica, they contain minerals like iron and manganese that give them different hues.

12. Phytosaur bones: Wood isn't the only thing that can be petrified. These phytosaur bones from Petrified Forest are all that remain of a phytosaur that died and was buried in silt before it was eaten by a *Metoposaurus* or it started to decompose. Phytosaurs fossils are by far the most numerous vertebrates (animals with a bony backbone) found at Petrified Forest. Phytosaurs were primitive members of the ruling class of animals at that time, the Reptiles, including the dinosaurs and their ancestors.

13. *Camarasaurus* Skull (Dinosaur National Monument): Some of the most well-known dinosaur fossils are found at Dinosaur National Monument in Colorado. This *Camarasaurus* was alive nearly 200 million years ago.....

14. Ancient Scene: and roamed the flood plains of a vast inland sea. It died and was buried in the silty bottom, laying there for millions of years and slowly becoming permineralized.

15. Picture Gorge, (John Day Fossil Beds): Petrified fossils from more recent times are found at several National Parks and Monuments. John Day Fossil Beds National Monument in Oregon contains an outstanding fossil record dating from 48 million years ago to 5 million years ago and has one of the world's most complete fossil records. The fossils were formed in a variety of ways. Hundreds of species of plants and animals fell into sinkholes or were buried by river and lake sediments or volcanic debris. There are four distinct rock formations represented in the John Day Fossil Beds. One of these is the.....

16. Clarno: Clarno Formation dating from 48 to 38 million years ago. At that time tropical to subtropical forests mantled the near coastal terrain.

17. Fossils: We know of these forests because of the splendid sample of fossil seeds, nuts, fruits, leaves, branches, and roots. The Clarno Nutbed is one of the finest fossil

plant localities on the planet, with hundreds of species, many new to science, preserved. The Nutbed was deposited in a lake delta and covered with sediment. Other Clarno fossils (mostly leaves and wood) were preserved when huge lahars swept down from nearby volcanoes and covered parts of the forest. Eventually the plant matter became permineralized and today we have a very detailed look at this ancient world.

18.Badlands Present Day; This is how Badlands National Park, in South Dakota, looks today...

19. Mosasaur: but 80 to 65 million years ago, during the late Cretaceous, it was under water, part of an inland sea. This mosasaur is not a dinosaur but a marine lizard that fed on molluscs and fish. It was common in near shore marine waters. It died and was covered by marine sediments, eventually becoming petrified.

20. Oligocene: The inland sea receded, giving way to lush jungle. 37 to 23 million years ago the climate changed to a drier, cooler environment, and jungles gave way to grasslands. To the west stood the young Rocky Mountains. Flash floods periodically swept out from the Rockies to the plains below, and the mud trapped and buried many animals. Volcanic eruptions in that mountain range spewed forth millions of tons of ash that periodically blanketed the area.

21. Petrification: These creatures that were buried under the mud or ash slowly became petrified...

22. Oreodont: Like this oreodont, an extinct animal that looked like a tapir, or pig. Oreodonts seem to have been very common, with many different members of the oreodont family having existed. Fossils of this type of animal are found at many different fossil sites. However, the family is now extinct with no living member or close relatives found anywhere on earth.

23. Agate Fossil Beds: Agate Fossil Beds National Monument is in northwestern Nebraska, along the Niobrara river.

24. Ancient Scene: 20 million years ago there was an ancient watering hole in the area, the ancestral Niobrara. Many different kinds of animals roamed the floodplain, like the large moropus, primitive dogs, hippopotamus, and rhinoceroses. A long drought resulted in the death of large numbers of these animals,

25. Fossils: When the rains finally came, large numbers of their skeletons were covered with sediments, and eventually permineralized.

26. Dozens of complete skeletons were discovered and give us a very accurate picture of what these animals looked like. Also, their discovery helps to give us a

more complete picture of the entire fossil record and how animals have changed through time.

27. Hagerman Fossil Beds Present Day: Hagerman Fossil Beds, in Idaho, is another example of a NPS fossil site with petrified fossils that helped fill in the picture of changing life through time.

28. Hagerman Ancient Scene: The fossils from Hagerman are dated to be very recent compared to the other sites we have seen; only about 3.5 million years old.

29. Hagerman Horse: The fossilized animals found there are very similar to modern day species, with the most famous; the Hagerman horse (*Equus simplicidens*) being the oldest known ancestor to the modern horse of today.

30. Wasp: A second type of fossil-is called a carbon fossil. This happens through a different chain of events. Florissant Fossil Beds is world famous for the carbon fossils found there. When most people think of fossils, they tend to think of large, petrified bones, yet at Florissant Fossil Beds we find delicate fossils of insects and leaves. This is what we think happened....

31. Today Florissant lies on the western flanks of Pikes Peak in Colorado, a land of rolling meadows and conifer forests...Ancient Florissant was quite a contrast!

32. Ancient Scene: The climate was warmer and much more mild than today, perhaps subtropical, with lush vegetation. Many prehistoric animals including brontotheres, oreodonts, three-toed horses and marsupials roamed the lush valley.

33. As you may remember from earlier in the show, there was a huge volcano near ancient Florissant. When it erupted it sent out huge lahars (mudflows), some covering trees and causing them to petrify. Some of the lahars flowed into the valley and blocked a stream that flowed there, damming it.

34. Lake Florissant: A lake nearly 12 miles long formed behind this dam.

35. The volcano continued to erupt, sending out clouds of fine, powdery ash. This was blown by the winds down into the valley, and some of the ash fell into the lake, making a thin layer at the bottom.

36. Drawing: The ash covered up plant leaves and insects that had fallen to the bottom of the lake, protecting them from scavengers and decomposition.

37. Drawing: This happened time after time, over a period of half a million years. As the layers built up on the bottom of the lake, the lake began to fill in and gradually dry up.

38. Shale: As the layers built up, they began to compress and harden from the weight and turned into a sedimentary rock called shale. Because of the very thin layers, the rock is called paper shale. Each layer represents a volcanic eruption or a period of sediment deposition on the bottom of the lake. The plants and insects gradually disintegrated, but the carbon in their bodies, the building blocks of their cells, stayed behind to leave a carbon fossil imprint.

39. Butterfly: When most people think of fossils they tend to think of huge dinosaur bones, not of delicate butterflies.

40. Butterfly fossil: yet at Florissant Fossil Beds we can find the remains of a butterfly that fluttered around the shores of ancient lake Florissant nearly 35 million years ago. The ash that covered the butterfly was so fine in texture, almost like talcum powder, that incredible details were preserved. Can you see the spots on the wings? The insect fossils found at Florissant are among the most detailed and abundant insect fossils in the world.

41. Fossil Butte National Monument is located in southwestern Wyoming. The high desert environment of today provides a sharp contrast with the past. Fifty million years ago this region was wet and subtropical.

42. Underwater scene: An enormous lake, 50 miles long and up to 15 mile wide, teemed with life. Fish and other organisms died...

43. Sediments: fell to the bottom of the lake and were buried by organic matter and calcium carbonate. (Calcium carbonate is a precipitate that formed when water evaporated or the lake chemistry changed).

44. Compressions of sediments: As layers built up on the bottom of the lake, compression and heat turned the mud to rock.

45. Fossil fish: Today we find the carbon remains of 6 foot gar, bowfins, turtles, stingrays, and more than 20 other freshwater species of fish. 46. Shells: A third type of fossil is a cast or a mold fossil. Internal molds are fossilized replicas of the internal structure of an organism. (Fossil on the right is an internal mold) The best examples of this type of fossil are clams or brachiopods. When a clam dies, over time the soft parts of the animal decay. The shell is left empty and this becomes filled with sediment. Eventually the shell dissolves away, but the sediments have hardened and remain as a fossil. The difference in casts and molds lies in what happens when the

shell dissolves away. If the shell dissolves before its empty cavity is filled it leaves a void in the surrounding rock, which then becomes filled with sediment. The "cast" fossil that forms in the cavity shows signs of the outer shell features, while an internal mold fossil will only show signs of the shell's internal features.

47. Footprints: Trace fossils are the preserved remains or signs of animals left behind as they went about their lives. They include footprints, like these dinosaur footprints, or tracks, burrows, nests, eggs and feces.

48. Shell Fossils: Some remains of ancient life are found as original material

49. *Baculites*: This baculite from the Pierre shales of Badlands National Park was a type of mollusk, an ammonite. The original shell material, mother of pearl, has been preserved for over 65 million years.

50. Pseudofossil: This is a pseudofossil, or false fossil. The coloration that looks like fossil leaves is really a mineral discoloration.

51. Ancient Sea Floor: Index fossils are fossils that are indicators of a particular time in the earth's history. Plants and animals that flourished for a short period of time and then became extinct are indicator species. To go extinct means that all members of a species die, NEVER to be replaced. If they became fossilized and occur in a particular rock formation, they are an indication (index) of the relative age of the rock.

52. Trilobites: Trilobites were an important group of marine invertebrates during the Paleozoic era. Because old forms were constantly dying out while new ones evolved, many species of trilobites serve as index fossils defining the time periods in which they lived. As a group, trilobites were part of a mass extinction that occurred at the end of the Paleozoic, during the Permian, 250 to 260 million years ago. That sounds like a long time ago, doesn't it?

53. Geologic time drawing: Geologic time can be difficult to comprehend. The time that we have spent looking at these slides is just a fraction of an instant in comparison to the age of the earth. There are activities you can do to try to put it into a framework we can understand, or a drawing like this can give you an idea.

54. All that we know about the history of life on Earth comes from studying fossils and the clues they give us about the past. You've seen the different types of fossil we find, learned how they were formed and seen the National Park Service areas that protect them. Thanks to the protection by the National Park Service, we, and future generations, can continue to learn about the history of our earth.

Post Slide Show Activities:

Make a time line showing the time periods that the different national Parks represent. Draw pictures, from memory or research, of the ancient landscapes and animals.

If you haven't already, try to visit the National Park nearest you to learn more about the fossils. Some questions you could ask are:

What kind of fossils are found here?

How were they formed?

How old are they?

What era, epoch and period do they represent?

How are the fossils dated?

How does the method work?

What kinds of life forms are represented?

When were they discovered?

When was the area made part of the National Park System?